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Procedures: change the outcoupler mirror of the High Power Oscillator

LIGO-T1300392-v1

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Motivation: The 50 % OC mirror has to be replaced by a HR mirror inorder to use the full 35 W of the frontend beam for the interferometer. PROCEDURE ONLY TO BE PERFORMED BY TRAINED PERSONAL.

Contents

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1 Preparation

- Have the transition procedures for HPM and LPM at hand (`https://dcc.ligo.org/LIGO-T1200025-v1`)
- An extra OC mirror mount and a HR mirror for 1064 nm, plane, transparent mirror material, AR coated back side, 35W beam needs to propagate through mirror material prior to reflection at HR surface.
- An additional beam dump (metal plate 3 mm thick)

2 Start situation: HPM or LPM

- PSL in high power mode:
  - Check the alignment of PMC and DBB (HPO path) with DBB mode scans (TEM 01 and TEM 10 < 1 %)
  - Turn off the HPO, follow the procedure for LPM transitioning (bullet point 1.1 -1.12), close the internal HPO shutter
  - Check the alignment of the DBB (HPO path with 17W) with a mode scan (TEM 01 and TEM 10 should still be below < 1 %)

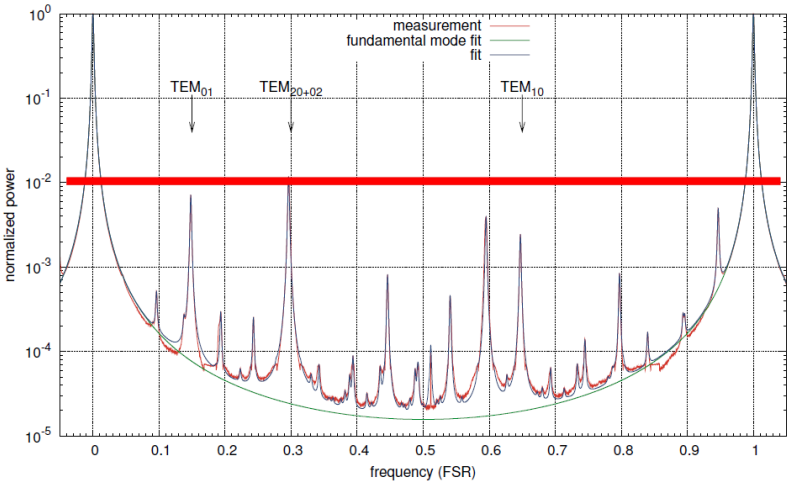

Figure 1: Example DBB mode scan

- PSL in low power mode:
  - Close the internal HPO shutter
  - Check the alignment of PMC and DBB (HPO path, with 17 W) with mode scans (TEM 01 and TEM 10 < 1 %)

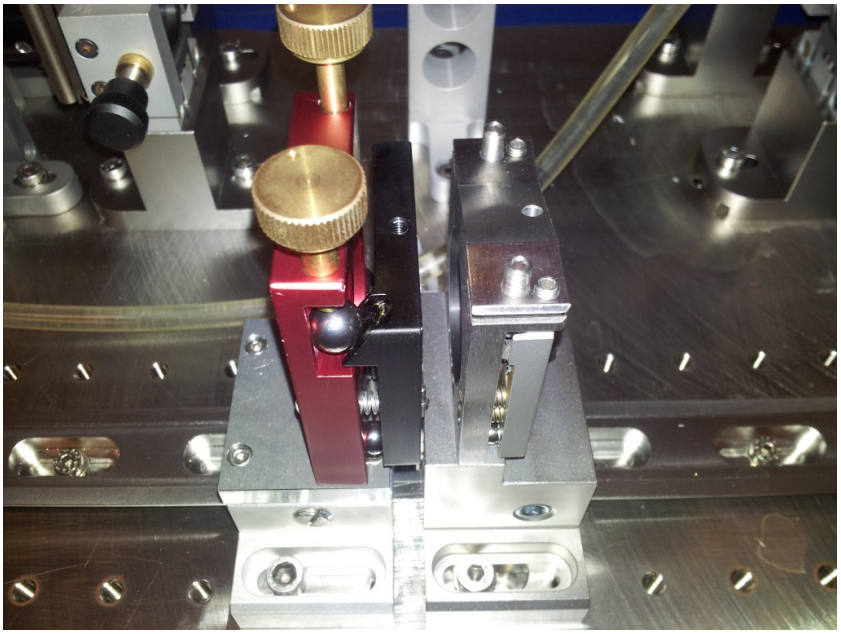

Figure 2: Example with a new mirror mount in front of the OC mirror, the beam dump has to be in between (not in the picture)

3 Procedures

- Don't touch the DBB alignment any more, because it serves as the reference from now on
- Mark the position of the frontend beam on the Wincam image (CCD02)
- Turning the half-wave plate WP01 so that full power is on PM01
- Reduce the power of the frontend by reducing the current from the Amplifier pump diodes to 0 A (just the first time, with prealigned mirror it's not necessary)
- Close the shutter in the frontend to stop the laser process of the amplifier
- Place the new mirror mount (with HR mirror) in front of the OC mirror, as close as possible with the HR layer facing towards the oscillator
- In case no HR mirror is at hand, a mirror with a small transmission is acceptable. In this case it is important to put some opaque material between this mirror and the OC to avoid a spurious cavity between them
- Open the shutter (FE)
- Align the beam back to the Wincam image by using exclusively the alignment screws of the new HR mirror mount
- Increasing the current to the diodes in 5 A steps back to full power, if necessary re-align the new HR mirror to the reference position on the Wincam

- Align the beam into the DBB back to the same mode content as previously (TEM 01 and TEM 10 < 1 %), using the new mirror mount and HPO M5 (CCD in transmission of the DBB is also helpful)
- Turning the half-wave plate WP01 back to full power to PMC
- Check alignment of the PMC
- Follow the procedure for the transition to HPM form bullet point 1.15 on, this will compensate for the new power level (35 W instead of 17 W starting from LPM respectively 180 W starting from HPM)

4 Back Procedures

- Check the alignment of DBB (HPO path) with DBB mode scans (TEM 01 and TEM 10 < 1 %)
- Don't touch the DBB alignment after setting it the first time, because it serves as the reference from now on
- Mark the position of the 35 W beam on the Wincam image (CCD02)
- Close Frontend shutter
- Remove extra mirror mount from the rail, leave it in the HPO box for later use, do not touch the alignment screws
- Open the shutter (FE)
- Align the beam into the DBB back to the same mode content as previously (TEM 01 and TEM 10 < 1 %), using HPO M5 (CCD in transmission of the DBB is also helpful)
- Follow the procedure for the transition to HPM